

**METHODS FOR FORMING ROUGH RUTHENIUM-CONTAINING
LAYERS AND STRUCTURES/METHODS USING SAME**

Abstract of the Invention

5 A method for forming a rough ruthenium-containing layer on the surface of a substrate assembly includes providing a ruthenium-containing precursor into the reaction chamber. A rough ruthenium layer may be deposited on the surface of the substrate assembly at a rate of about 100 Å/minute to about 500 Å/minute using the ruthenium-containing precursor. Further, a rough ruthenium oxide layer may be formed by providing a ruthenium-containing precursor and an oxygen-containing precursor into the reaction chamber to deposit the rough ruthenium oxide layer on the surface of the substrate assembly at a rate of about 100 Å/minute to about 1200 Å/minute. An anneal of the layers may be performed to further increase the roughness. In addition, 10 conductive structures including a rough ruthenium layer or a rough ruthenium oxide layer are provided. Such layers may be used in conjunction with non-rough ruthenium and/or non-rough ruthenium oxide layers to form conductive structures. For example, 15 such structures may be part of a capacitor structure, e.g., bottom electrode of a capacitor.

20

"EXPRESS MAIL" MAILING LABEL NUMBER EL888270894US

DATE OF DEPOSIT 25 October 2001
I HEREBY CERTIFY THAT THIS PAPER OR FEE IS BEING DEPOSITED WITH THE
UNITED STATES POSTAL SERVICE "EXPRESS MAIL POST OFFICE TO ADDRESSEE"
SERVICE UNDER 37 CFR 1.10 ON THE DATE INDICATED ABOVE AND IS ADDRESSED TO
THE ASSISTANT COMMISSIONER FOR PATENTS
WASHINGTON, D.C. 20231

PRINTED NAME Jacquelyn K. Torborg
SIGNATURE Jacquelyn K. Torborg